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Fuel For Thought

By W. T. BRICKENDEN, B.A. Sc., M.E.
Thorne, Mulholland, Howson & McPherson, Toronto, Ont.

(Before Toronto Chapter, February 19, 1936)

THE general lack of appreciation of the economic importance of determining and controlling steam production costs may be done to the failure of those responsible to fully understand the simple principles involved and while you, as cost accountants may feel that a knowledge of these principles is outside the realm of your activities, yet I believe that the cost accountant in most organizations is far better fitted to accumulate and present these figures than some members of the staff. It is my hope therefore, that I may not only create a desire on the part of those present to delve into the question of steam costs, but also to give you without going into too much detail sufficient fundamental information as to enable you to intelligently compile and interpret the necessary figures.

It does not make any difference whether your plant is small or large, or whether the equipment is new or old, if fuel is burned to produce steam for comfort or industrial purposes, the cost of steam production should be known. The raw material—fuel—is burned to manufacture the product — heat — which is transported through the medium of steam to the various objects throughout the plant. The boiler room or power plant then is just as much a production or cost centre as any other division and should be set up in your accounts as such.

There is probably no other manufacturing division in your business that presents as great possibilities for immediate savings as does the fuel burning plant. I use the term "fuel burning plant" advisedly as in too many places it is considered just that. I can assure you that, if you do not now keep current cost records of the steam production plant, you have a real opportunity of proving to the management that the cost department can partly or wholly justify its existence, through the savings in fuel consumption. In most plants the minimum saving could be estimated as ten per cent.

While many attempts have been made to devise standard costing methods to enable comparisons between companies in an industry, there has been no noteworthy success recorded except in one, that of the steam production industry. Here, a standard means of comparing results and efficiency has been in use for many years. It

enables any plant operator, regardless of the size or type of plant to compare the results obtained in his plant with those of any other steam plant or with results that should be attained with the equipment available.

Let us assume that you have decided to incorporate a cost centre for the steam production department. What are the steps necessary to put this in effect?

Before proceeding I would like to point out that for the sake of simplicity, I am considering only coal as the fuel used, as it is the most common in use here and while the actual figures involved would be different for other fuels such as oil or gas, the principles are the same. It is not my intention to review in detail all factors involved but to confine my remarks to such fundamentals as will enable you to apply them in a practical way.

Nature of the Process

Before setting up a workable cost system it is essential to know the nature of the process. In this, we are dealing with an invisible product—throughout the process—heat. In spite of all the variety of equipment used, we are simply endeavouring to transfer this heat, resulting from the chemical process of burning the coal, in the most efficient way possible, to the desired object. From start to finish of this process there are more than the usual opportunities for losses due to the invisibility of the product and its ability to escape and go places where it is not required. All known substances conduct heat, some retard the rate of flow and are commonly called insulators but don't forget that all of them conduct heat even if the flow is restricted. In view of the nature of the problem, therefore, the desirability for its close control through proper records is obvious.

Raw Materials

In this process there are three main raw materials, coal, air and water.

Air—Air is free and therefore does not enter into our cost calculations, although its proper use and control is of prime importance. Air, as you know, is a mixture of gases consisting of roughly, 20% oxygen and 80% nitrogen, plus traces of other gases. The oxygen is the only active element in the burning of fuel, nitrogen serving no useful purpose but to the contrary introduces an unavoidable loss by carrying otherwise useful heat out the chimney into the atmosphere. In order to keep this loss to a minimum, it is therefore, important to prevent more air than is necessary for proper combustion of the fuel to get into the furnace. The amount of air used should be controlled as carefully as more costly materials for while the direct cost is nil the indirect cost due to increased losses may become a serious factor. Up to twenty-five per cent. of the heat in the fuel can easily be lost through excess air. The methods of avoiding

such a condition are well known to most operating engineers and do not enter directly into our cost calculations.

Coal—I believe our cost analysis should start with an investigation of the method of purchasing the coal. It is quite common for the purchasing department to buy coal on a purely price per ton basis sometimes modified by reports of the fireman whose knowledge of the actual performance of the dollars and cents cost basis is usually very limited or entirely lacking. The cost of coal is not represented by its cost per ton delivered and supplies purchased on this basis are usually very costly.

In southern Ontario, where the source of supply is relatively a long distance from the point of use, the greater part of the cost of the coal represents freight and other charges. Here are two examples of well known coals of the so called "stoker" size from the two main coal producing areas—West Virginia and Pennsylvania fiields.

	Elkhorn (Kentucky)		Adrian (Pennsylvania)	
Cost at Mine	$1.50	23%	2.35	36%
Freight and Duty	5.09	77%	4.18	64%
Cost Cars Toronto	$6.59 per ton		$6.53 per ton	

The difference in cost between a good or suitable coal and an inferior one will probably not be more than twenty-five cents a ton. This difference appears large when compared on "the cost at mine basis" but is less than 5% when on "the delivered basis." When I tell you that an inferior grade of coal may increase your coal consumption ten to twenty per cent, or more, you can realize the advisability of making sure that the coal purchased for your plant is suited to the requirements of the facilities available. Actual test under operating conditions is the only way to determine the best coal to use—and cost figures must be available in checking results.

You may well ask what can the cost accountant do about the purchasing of coal? Well, if you have records of performance, you can supply the purchasing department with cost figures that will ensure adequate action.

The first information required in this cost centre is the quantity of coal used in whatever unit of time decided upon. May I suggest that as a beginning, the quantity be determined daily. It may be desirable later to change this in order to give better control of the different load periods of the day or to set up incentives for the foremen on the different shifts. The actual weighing of the coal can be accomplished in a variety of ways, depending on the type of fuel burning equipment used. If the coal is handled mechanically, automatic scales are available for the purpose. If the coal is handled manually, a platform scales and a wheelbarrow will do the trick. If the powers that be will not provide the scales, load up the wheel-

barrow with coal and run it on the shipping department scales—determine the net weight of coal contained and arrange for the fireman to keep a record of the number of loads used during the day. A piece of chalk and a place to mark down the loads is all that is necessary. It may be desirable to suggest to the fireman that you are checking the coal used with the amount purchased and that any discrepancy will be detrimental to his interests.

It has been found in most instances that the simple procedure of introducing such a record of coal burned results in an immediate reduction in the amount of fuel burned. Most firemen when they learn how much coal they are handling, begin to work for ways and means to reduce the amount. It sounds more to say that "you shovelled 5 tons of coal today" than it does to say "you shovelled all day long." If you don't go any farther than this your efforts will, I feel sure, bring lower fuel consumption so be sure to weigh or determine the daily fuel consumption and keep daily and cumulative records, even if the coal consumption is only a ton per day.

There are so many variables concerned such as moisture content and heat value of the coal and the amount of fuel on the grates at the beginning and end of the daily period, etc. that it is not necessary to obtain great accuracy in weight. It is only desirable to obtain reasonable and comparable figures.

Water—While the cost of the water supplied to the boiler room enters into our final calculations, at the moment I wish to consider only the use of this water in the boiler and system itself.

First I would like to make clear that the terms "a pound of water" and "a pound of steam" are one and the same thing. They are both one pound of the same substance—water, and in our calculations the terms are interchangeable.

Water in the form of steam is used as the medium of carrying and transferring the heat produced by the burning coal to the place where we need it. The reason water is used is because it is cheap and requires a relatively large amount of heat to change it from the liquid to the vapour stage. The term applied to this quantity of heat is "latent" heat. Experimental investigation has established the amount of heat required to produce steam under various conditions and therefore arrive at the amount of heat absorbed by the steam from the burning coal it is only necessary for us to obtain the pounds of water or steam produced during the same periods for which we have determined the amount of coal burned.

There are two general ways in which to determine the quantity of water evaporated or changed into steam. First is by measuring the quantity of water fed to the boilers—by using a hot water meter or a condensate meter or recording the number of times a tilting trap operates, etc. The advantage of this method is, that it is cheap

and while allowances have to be made for losses of water from the boiler due to blow-down, etc., the results obtained can be made sufficiently accurate for ordinary purposes of comparison and control. The second method is to measure the pounds of steam produced by using a steam flow meter on the main steal line from the boiler. This equipment is more expensive but whether the increased investment is warranted depends upon local conditions. Whichever method is used—obtain the pounds of water evaporated during the same period of time during which the coal is weighed.

We now have two production figures for the same period of time.

1. Pounds of coal burned.
2. Pounds of water evaporated or steam produced.

Our first figure of comparison then is to determine the actual pounds of water evaporated per pound of fuel. This figure is all that is necessary for you to use for comparison from day to day or month to month in your own plant, as it is a measure of the efficiency of your boiler, furnace and fuel burning equipment. This also can be used for determining relative merits of different fuels.

In order to enable you to compare your results with what you should obtain, I have prepared Table I showing the approximate actual evaporation per pound of coal under average operating conditions for a hand fired and a stoker fired installation.

TABLE 1
ACTUAL POUNDS OF WATER EVAPORATED PER POUND OF COAL

Heat Value of Coal as fired BTU	Hand Fired Grates Steam Pressure (lb) Guage				Stoker Fired Steam Pressure (lb) Guage			
	15	50	100	150	15	50	100	150
12,000	6.71	6.60	6.54	6.52	8.02	7.93	7.83	7.80
13,000	7.25	7.15	7.08	7.05	8.69	8.59	8.48	8.45
14,000	7.82	7.70	7.63	7.60	9.36	9.26	9.14	9.11

The figures on this table are based on certain assumptions as to conditions in the average plant and also as to the efficiency that should be attained with the two types of fuel burning equipment.

You will note that the evaporation per pound of coal varies with the heat value of the coal and also with various steam pressures. The heat value of the coal can be obtained by analysis or may, with some reservations, be obtained from the coal dealer. Coal dealers are not always dishonest but you can be sure that the heat value quoted by them is as high as the best analysis of the coal shows. It costs only $10.00 to check their figure and it may prove a profitable investment.

Do not be discouraged by the term B.t.u.—British thermal unit. It is purely the arbitrarily set unit of measurement of the quantity

of heat. We are all familiar with the yard stick yet I venture to say that few, if any of us present, can correctly define what a yard is—yet we use it every day. So with the B.t.u.—use it as you do a yard stick. You do not need to know its origin or how to verify it. The steam pressure is obtainable from the steam guage on the boiler so that you will have no difficulty in using this table.

A word about steam pressures here may be worth the time. There is a mistaken idea that coal can be saved by lowering the pressure at which steam is generated. I do not wish to discuss this in detail but only wish to say that generally the lowering of steam pressure will not reduce but will probably increase the cost of producing steam.

Should it be desirable to compare the results of operations in your plant with those of others, it is necessary to obtain additional information so as to convert your figures to a standard basis for comparison. This standard basis is known as the Equivalent evaporation per pound of coal. In order to calculate this it is only necessary to know in addition to the measurements of coal and water, the average temperature of the water being fed into the boiler and the average steam pressure both during the same period of time.

Knowing these two figures, it is possible to obtain a multiplying factor from a table called "Factors of evaporation" to convert the actual to the equivalent evaporation per pound of coal. Table 2 is such a table in condensed form.

TABLE II
FACTORS OF EVAPORATION

Temperature of Feed Water	Steam Pressure (lb. gauge)			
Degrees F.	15	50	100	150
80	1.150	1.164	1.177	1.186
100	1.129	1.144	1.156	1.165
120	1.109	1.123	1.136	1.145
140	1.088	1.102	1.115	1.124
160	1.067	1.081	1.094	1.103
180	1.047	1.060	1.073	1.082
200	1.026	1.039	1.052	1.061

To obtain the equivalent evaporation per pound of coal you simply multiply the actual evaporation by the proper factor from the table.

After determining this figure it is now easy to calculate the efficiency of the steam producing plant. This is obtained by multiplying the equivalent evaporation per pound of fuel by 970.4 and dividing the B.T.U. value of the coal as fired, multiplying by 100 gives the percentage figure.

This method of arriving at the efficiency of the plant is only approximate and some of our more scientific friends may raise objections but for all practical purposes of control and comparison the efficiency obtained by this method is close enough and to obtain greater accuracy only introduces factors more difficult to measure and unnecessarily complicates the procedure.

Once having calculated the efficiency of your plant for an operating period, it is then desirable to determine whether the results disclosed are what they should be. While the efficiency that can be attained in any plant depends on both the type of equipment in use and operating conditions, table III gives approximate operating efficiencies for comparative purposes.

TABLE III

DAILY OPERATING EFFICIENCIES —%—

	Poor	Ordinary	Desirable
Hand Fired	45-50	50-60	over 65
Stoker Fired	50-60	60-68	over 72

Having arrived at the efficiency of operation you are in a position to start your campaign for better results. It is surprising the number of plants both large and small, well equipped and otherwise, which are operating at efficiencies classed as poor and the reason for this can usually be traced to lack of information as to actual operations.

Cost Figures

The next consideration is to convert our production figures into dollar values. The recommended method for your purpose is to determine the cost per one thousand pounds of steam produced. (Another method is based on cost per 1,000,000 B.T.U.'s in the steam.) The reason for arriving at this cost figure is that it provides a convenient method of distributing steam costs to the various other cost centres in the plant. It is not a very difficult matter to ascertain, reasonably accurately, the steam used by various cost centres. In larger plants, the quantity can be determined by meters and in the smaller plants by test or by estimate.

For purposes of control, I would suggest that the cost per 1,000 pounds of steam be compiled in four elements.

1. Coal Cost
2. Expense Items
3. Labour Cost
4. Fixed Charges (depreciation, etc.)

These may be calculated for whatever period desired but it is more convenient to make the period coincide with regular cost periods, whatever they may be.

1. **Coal Cost:**

(a) First Method

Knowing the actual pounds of water evaporated per pound of coal, it is easy to calculate the pounds of coal burned per 1,000 pounds of steam. Multiplying this figure by the cost of coal gives the cost of coal per 1,000 pounds of steam produced.

(b) Second Method

Knowing the total number of pounds of steam produced and coal burned during the period, the pounds of coal required to produce 1,000 pounds of steam can be obtained by division. Multiplying by the cost of coal gives the coal cost per 1,000 pounds of steam.

Both methods should give the same result if the figures are calculated for the same period.

The reason for determining the coal cost above is that it will give you correct figures for comparison of the following:—

(a) relative merits of different kinds of coal.
(b) effect of changes in equipment
(c) methods of operation
(d) effect of changes in load conditions

2. **Expense Items:**

By expense items, I refer to those items of expenses which are more or less dependent on the amount of steam produced and include the following:—

(a) Cost of make-up water supplied to the boiler room. This may be purchased from city or town supply or pumped from own source.

(b) Water conditioning equipment supplies. This covers all types of chemicals used in the treatment of water for boiler use.

(c) Repairs and maintenance to boiler room equipment.

(d) Electric light and Power used in driving fans, stokers, pumps, etc., in the boiler room.

(e) Ash disposal. This may be a charge or a credit depending on whether it is possible to sell cinders in the local market.

(f) Miscellaneous expense supplies such as oils, greases, waste, etc.

The cost per 1,000 pounds of steam of the above items can be calculated individually or in total, depending on the amounts involved.

3. **Labour Costs**

This is simply the total cost of labour in the boiler room including superintendence per 1,000 pounds of steam produced.

4. **Fixed Charges:**

Fixed charges would include such items as

(a) Fire and boiler insurance.

(b) Rent or proportion of general plant expenses (such as taxes) chargeable to space occupied by boiler room.

(c) Depreciation on boiler room building and equipment.

The cost of these is calculated per 1,000 pounds of steam produced.

The total of sections 1, to 4 is the total cost of producing 1,000 pounds of steam.

In some industries, where fuel costs comprise an important portion of the cost of the product it may be desirable for proper control to determine figures based on units of product produced. The best figure to use would depend on circumstances but might be one or more of the following:

(a) Pounds of coal required to produce one unit of product.

(b) Pounds of steam required to produce one unit of product.

(c) Cost of coal required to produce one unit of product.

(d) Cost of coal, Labour and Expense required to produce one unit of product.

(e) Total cost of steam required to produce one unit of product.

When you have carried out the suggestions made in this paper and if you don't I would consider that you are neglecting your duty, you will be in a position to determine steam costs on whatever basis is required and also to reduce and properly control the cost of producing steam. I can only repeat in conclusion that the possibility of real savings exists in every plant where cost figures as outlined are not now available.

EXAMPLE "A" Operating Comparative Figures Appendix 1

1. Obtain coal burned in period (24 hrs.) say— 2250 lb.
2. Obtain water evaporated same period —16200 lb.
3. Determine actual pounds of water evaporated per pound of coal burned $\frac{16200}{2250} = 7.2$ lb.
4. Obtain average steam pressure — 100 lb. gauge
5. Obtain heat value of coal burned —13000 B.T.U./lb. as fired
6. Compare results of (3) with Table I.
   Assuming stoker fired—should produce 8.48 lb. steam per lb. of coal, but only obtained 72 lb.

TABLE I.

ACTUAL POUNDS OF WATER EVAPORATED PER POUND OF COAL

Heat Value of Coal as	Hand Fired Grates Steam Pressure (lb.) gauge				Stoker Fired Steam Pressure (lb.) gauge			
fired B.T.U.	15	50	100	150	15	50	100	150
12,000	6.71	6.60	6.54	6.52	8.02	7.93	7.83	7.80
13,000	7.25	7.15	7.08	7.06	8.69	8.59	8.48	8.45
14,000	7.82	7.70	7.63	7.60	9.36	9.26	9.14	9.11

7. Obtain average feed water temperature —120 degrees F.
8. From Table II determine "factor of evaporation"—1.136

TABLE II.
FACTORS OF EVAPORATION

Temperature of Feed Water Degrees F.	Steam Pressure — (lb. gauge) 15	50	100	150
80	1.150	1.164	1.177	1.186
100	1.129	1.144	1.156	1.165
120	1.109	1.123	1.136	1.145
140	1.088	1.102	1.115	1.124
160	1.067	1.081	1.094	1.103
180	1.047	1.060	1.073	1.082
200	1.026	1.039	1.052	1.061

9. Determine equivalent evaporation No. (3) x No. (8)=7.2 x 1.136 =8.18 lb. steam per pound of coal "from and at 212 degrees F."
10. Determine efficiency

$$\frac{\text{No. (9) x 970.4 x 100}}{\text{No. (5)}} \quad \frac{8.18 \times 970.4 \times 100}{13{,}000} = 61.06\%$$

Appendix 2.

11. Compare with Table III to find that results fall in "ordinary" classification.

TABLE III
DAILY OPERATING EFFICIENCIES—%

	Poor	Ordinary	Desirable
Hand Fired	45—50	50—60	over 65
Stoker Fired	50—60	60—68	over 72

EXAMPLE "B"—Costs

12. Obtain cost of coal per lb. delivered $\frac{\$600 \text{ per ton}}{2000} = 0.3\text{c per. lb.}$
13. (a) Determine lb. of coal per 100 lb. steam $\frac{1000}{\text{No.(3)}} = \frac{1000}{7.2} = 139.$
    (b) 1. Obtain lb. of coal burned per cost period (month) say 44,000 lb.
    2. Obtain lb. of water evaporated same perod, say 320,000 lb.=320 M lb.
    3. Determine lb. of coal per 100 lb. steam $= \frac{44{,}000}{320} = 137$ lbs.

(difference in (a) and (b) 3 above due to different periods of time)

14. Determine cost of coal per 1000 lb. steam
No. (13) x No. (12)=137 x .3=41.1c.

15. Obtain expense costs for period

Water	13.00	
Salt	2.00	
R & M	26.00	
P & L	12.00	
Ash Disposal	3.00	(cr) (2 loads sold at 1.50)
Miscellaneous	4.00	
Net Total	54.00	

16. Determine expense cost per 1000 lb. steam

$$\frac{\text{No. (15)}}{\text{No. (13(b)2)}} = \frac{54.00}{320} = 16.8\text{c.}$$

17. Obtain total wages per cost period (month) say $150.00
18. Determine wage cost per 1000 lb. steam

$$\frac{\text{No. (17)}}{\text{No. (13(b)2)}} = \frac{150.00}{320} = 46.9\text{c.}$$

19. Obtain fixed charges per cost period Insurance, rent, depreciation —say $100.00
20. Determine fixed charges per 1000 lb. steam

$$\frac{\text{No. (19)}}{\text{(No. (13(b)2)}} = \frac{100.00}{320} = 31.2\text{c.}$$

21. Determine total cost of 1000 lbs. steam

No. (14) coal	.411
No. (16) labor	.168
No. (18) expense	.469
No. (20) fixed	.312
Total cost:	$1.36

"C" Questionnaire to assist in improving faulty operating conditions.

1. Boiler settng tight so that no air can leak in over the fire, around boiler, or around doors?
2. Boiler damper working and used to adjust minimum draft requirements to load?
3. Boiler tubes clean inside and out? Regular periods for internal washing and external tube cleaning?
4. Grates in good repair?
5. All condensate returned to boiler?
6. No steam exhausting to atmosphere?
7. Steam lines all tight and traps all working properly?
8. Steam pipes insulated?
9. No combustible (coal or coke) in the ash?
10. Operators properly instructed as to operation of equipment to obtain the best results?

MINUTES OF ANNUAL MEETING

Minutes of annual meeting of The Canadian Society of Cost Accountants and Industrial Engineers, held in Montreal, May 30, 1936, at 3 p.m. at the Windsor Hotel.

Minutes: Minutes of the last annual meeting as printed in Cost and Management of June, 1935, were approved.

Financial Statement: The financial statement for the year ended April 30, 1936, was read. Moved, seconded and carried. That this statement be accepted, subject to audit.

Report of President and Directors: The report of the President and directors for the year ended April 30, 1936, was read. Moved, seconded and carried. That this report be approved.

Montreal Chapter: The chairman reported that at the meeting of directors just held, a special grant of $200 to Montreal Chapter, to cover its deficit of the past year, had been made.

Past-presidents' Committee: The chairman outlined the contents of a report of a committee of past-presidents which had been adopted with amendments at the directors' meeting. Moved, seconded and carried. That this report be approved. (Published herewith).

Chapter Activities: The chairman outlined the contents of a report of the Committee on Chapter activities. Moved, seconded and carried. That this report be received and adopted. (To be published).

Convention Committee: Moved, seconded and carried, That a committee of three be appointed to consider the advisability of holding a convention at the time of the annual meeting in 1937.

Election of Directors: The secretary read the following names proposed by chapters as directors of the Society: G. T. Bowden, P. E. Dufresne, J. P. Masterson, D. R. Patton, J. Paul Rolland, and P. W. Wright, of Montreal; G. R. M. Dingle, C. D. Landell, W. M. Lane, E. D. MacPhee, K. A. Mapp, S. H. Sorley and J. W. Spence, of Toronto; M. I. Long and H. P. Wright, of Hamilton; E. Tailby, of Central Ontario. Moved, seconded and unanimously carried, That these be elected directors of the Society for the ensuing year.

Thanks to the President: Moved, seconded and unanimously carried, That the Society extend its thanks to Mr. R. W. Louthood for his active interest and work in the Society during the past year.

Thanks to Auditors: Moved, seconded and unanimously carried, That the Society extend its thanks to Fred Page Higgins, F.C.A., and C. H. Pelling, C.A., for acting as auditors, and that they be reappointed.

The meeting then adjourned.

R. W. Louthood, Chairman W. A. McKague, Secretary.

REPORT OF PRESIDENT AND DIRECTORS

(Report of president and directors, presented at annual meeting, Montreal, May 30, 1936)

We have pleasure in reporting as follows, on the activities of the Society in the year ended April 30th, 1936:

Membership: A small decline in membership is recorded, the following being a comparison with a year ago:

	April 30, 1935	April 30, 1936
Montreal	102	106
Toronto	130	118
Hamilton	35	34
Central Ontario	12	14
Winnipeg	16	11
Non-resident	21	24
Student (in Montreal)	3	10
Totals	319	317

Our membership trophy for the Chapter showing the greatest percentage gain for the past year has been awarded to Central Ontario Chapter, W. L. Jardine, chairman.

Finances: The resulting slight decline in membership fees was offset by an increase in publications revenue, from subscriptions and advertising and the Society's financial statement for the year shows a surplus of $22.59, making an accumulated surplus of $3,941.14. which is in Ontario government bonds and cash.

Chapters: Although the Winnipeg Chapter was not active, the other four chapters held programs of meetings as usual. Chapter finances continue in good shape except for a deficit in Montreal. The following is a summary of their statements for the year.

	Balance brought Forward	Receipts	Expenses	Balance carried Forward
Montreal	$ 46.60	$516.39	$687.69	—$124.70
Toronto	514.19	572.00	443.60	642.59
Hamilton	69.60	166.97	155.63	80.94
Central Ontario	46.35	78.65	26.40	98.60
Winnipeg	310.30	63.99	6.23	368.06
	987.04	1,398.00	1,319.55	1,065.49

Publications: Our monthly magazine Cost and Management was issued regularly during the year, to members and subscribers, the revenue from subscriptions and sales being $238.00, and the revenue from advertisements $231.08.

Reference Literature: Members of the Society continue to make use of our reference literature to about the same extent as in previous years.

Examinations: Candidates were examined in Montreal in May, 1935, the number passing being as follows: First examination: Bookkeeping, 3; Accounting, 2; Cost Accounting, 8. Second Examination: Cost Accounting, 4; Business Organization and Administration, 4. One candidate completed all requirements to receive our Certificate.

All of which is respectfully submitted.

R. W. Louthood, President. W. A. McKague, General Secretary.

FINANCIAL STATEMENT

The Canadian Society of Cost Accountants & Industrial Engineers (Financial statement as submitted at the annual meeting, subject to audit)

Year ended April 30, 1936

Balance Sheet April 30, 1936

Assets

Cash in bank		$2,133.64
Investments at cost		1,992.95
		4,126.59

Liabilities

Membership fees received in advance		185.45
Surplus:		
Balance May 1, 1935	3,918.55	
Year ended April 30, 1936	22.59	3,941.14
		4,126.59

Revenue and Expenditure

Year ended April 30, 1936

Revenue:	
Membership fees	$4,429.90
Interest earned	118.75
Publications Revenue	469.08
Examination fees	40.00
	5,057.73
Expenditures:	
General expense	1,790.35
Chapter allowances	1,391.91

Publications expense	1,745.54
Examinations	81.92
Bank Exchange	25.42
Surplus for year	22.59
	5,057.73

(The above statement does not include Chapter finances. Separate statements of chapters are printed herewith.)

CHAPTER FINANCIAL STATEMENTS

MONTREAL CHAPTER

Statement of Cash Receipts and Disbursements
For the year ended 30th April, 1936

Receipts		
Chapter's Share of Membership Fees from Central Office		$ 515.33
Membership Fee paid direct to Chapter		10.00
Bank interest		1.06
		526.39
Excess of Disbursements over Receipts		171.27
		697.66
Disbursements		
Secretarial Fees		290.00
Printing, Postage and Stationery		
Programmes and Membership Cards	48.92	
Notices	34.30	
Stationery	50.68	
Postage and Supplies	22.71	
		156.61
Delegates' Expense—Annual Meeting		30.15
Lecture Room—Chapter Meetings		22.00
Publicity—Educational Committee		19.76
Flowers—Welfare Committee		18.75
Interest and Exchange		4.30
Membership Fee remitted to Central Office		10.00
Net Loss on Chapter Meetings and Social Functions as per schedule attached		146.09
		697.66

Cash in Bank 1st May, 1935		46.57
Add Receipts	526.39	
Bank Loan	200.00	726.39
		772.96
Less Disbursements		697.66
Cash in Bank 30th April, 1936		75.30

Auditors' Certificate

We have audited the books and accounts of the Canadian Society of Cost Accountants and Industrial Engineers, Montreal Chapter, for the year ended 30th April, 1936 and have obtained all the information and explanations required by us. We certify that in our opinion the above statement of Cash Receipts and Disbursements correctly sets forth the result of the operations of Montreal Chapter for the year ended that date according to the best of our information and the explanations given to us and as shown by the books of the Chapter.

R. W. Stevenson
H. W. Blunt,

Montreal, 14th May, 1936 — Chartered Accountants.

Schedule of Cash Receipts and Disbursements
Chapter Meetings and Social Functions
For the year ended 30th April, 1936

Functions	Receipts	Disbursements	Profit or Loss
Closing Dinner 1935	65.25	57.92	7.33
Plant Visit—Three Rivers	113.15	112.88	.27
Presentation—P. E. Dufresne	16.00	20.00	— 4.00
Dinner and Presentation—J. P. Masterson	24.00	36.00	—12.00
Dinner and Presentation—R. Schurman	30.00	33.21	— 32.1
Opening Dinner 1936	298.00	352.88	—54.88
Plant Visit—Bell Telephone Co.	108.00	118.17	—10.17
Chapter Meeting—E. Camman C.P.A.		51.52	—51.52
Directors' Meeting—Invited Guests		8.60	— 8.60
Smoker 1936—Tickets		5.95	— 5.95
Golf Tournament—Engraving Cup		.30	— .30
Harbour Trip—Advertising		3.06	— 3.06
	654.40	800.49	—146.09

TORONTO CHAPTER

Statement of Receipts and Payments
For the year ending April 30, 1936

Receipts	
On deposit in Bank of Montreal, May 1, 1935	$ 514.19
Percentage Allowance from Canadian Society of Cost Accountants and Industrial Engineers, as per statement from Dominion Secretary	572.00
	$1,086.19
Payments	
Regular Meetings (8), Net Loss	$ 61.90
Bankers Night	50.00
Music at Meetings	10.00
Stationery, Postage, etc.	53.05
Special Allowance for Secretarial charges, etc. to Canadian Society of Cost Accountants and Industrial Engineers	150.00
Estimated Cost of Annual Meeting, May 7, 1936	118.65
Total Actual and Estimated Payments	443.60
On deposit in Bank of Montreal, April 30, 1936, (after deducting Estimated Cost of Annual Meeting as above.)	642.59
	$1,086.19

Auditor's Certificate

I have audited the accounts of The Canadian Society of Cost Accountants and Industrial Engineers (Toronto Chapter) for the year ending April 30, 1936, have verified the amount on deposit in the Bank of Montreal, and certify that the above statement of Receipts and Payments is correct and in agreement with the books.

A. Ross Browne
Chartered Accountant

May 4, 1936

HAMILTON CHAPTER

Statement of Receipts and Expenditures, Season 1935-36

Receipts	
Balance, May 1st, 1935	$ 69.60
C. S. C. A. Grant	166.67
Bank Interest	.30
	$236.57

Expenditures		
Wentworth Arms (1934-5)	3.00	
Annual Golf	8.35	
Taylor Meeting	13.40	
Morris Meeting	3.60	
Williamson Meeting	1.80	
Beatty Meeting	3.65	
Smye Meeting	1.20	
Dingle Meeting	4.20	
Taylor Meeting	3.65	
Ferguson Meeting	1.20	
Creed Meeting	1.20	
		45.25
Printing		5.85
Notices of meetings, etc.		25.31
Postage, Telephone and Telegraph		9.92
Attendance Prizes		9.00
Exchange		.30
Expenses of Secretary's Office 1934-5		30.00
Expenses of Secretary's Office 1935-6		30.00
Balance on hand April 30th, 1936		80.94
		$236.57

CENTRAL ONTARIO CHAPTER

Receipts		
Balance May 1st, 1935		$ 46.35
Received from Society		78.65
		$125.00
Expenditures		
Expenses of meetings		$ 26.40
Balance April 30, 1936		98.60
		$125.00

WINNIPEG CHAPTER

Statement of Receipts and Disbursements
For period April 1st, 1935 to March 31st, 1936

Receipts	
Cash at Bank as at April 1st, 1935	$ 247.16
Cash on Hand as at April 1st, 1935	2.94
Cash received from Toronto, November 27th, 1935	60.00

Cash received from Toronto, November 27th, 1935		60.00
Interest earned		3.99
		$395.09
Disbursements		
Expenses—Annual Meeting 1935	20.65	
Postage	.28	
Exchange	.30	
Expense re Luncheon December 3, 1935 (General Meeting)	5.80	
		27.03
Excess of Receipts over Disbursements		368.06
Cash at Bank		365.70
Cash on hand		2.36
		$368.06

Certified Correct
G. H. SHEPPARD
Winnipeg, Manitoba, 31st March, 1936 Secretary-Treasurer

REPORT OF COMMITTEE OF PAST PRESIDENTS TO THE BOARD OF DIRECTORS, MAY 30TH, 1936

(As Amended at Directors' Meeting, May 30, 1936)

To The Board of Directors, Canadian Society of Cost Accountants & Industrial Engineers:

Your Committee of Past Presidents, to which was referred for study and report the resolution submitted at our last annual meeting by the Montreal Chapter, copy of which is attached hereto, beg to report as follows:

Your Committee has given careful consideration to the resolution above referred to and also to a brief submitted by the Montreal Chapter in support of their contentions.

Your Committee realizes the importance of the activities of the individual chapters in the work of the Society. In a large measure, the membership of the Society will be retained and augmented by what the chapters have to offer to their members in the way of well planned programs. We are of the opinion that better results could be obtained by having the members' fees collected by the local chapters, since by so doing a closer contact with the members would be develop-

ed, and in some cases, delinquency might be prevented through local contact.

Your Committee feels that consideration must be given to those members who are prevented from participating in chapter activities. To these all we have to offer is the magazine and general information, etc. from our Head Office.

Again, the importance of our Society as a "Dominion" one must be stressed. If we are to take our place in Canadian affairs and exercise an influence on Canadian industry and finance, we must be national in character.

Your Committee therefore is of the opinion that what is required at the present time is some form of decentralization which, while strengthening the chapters, will still permit the maintenance of a Headquarters capable of co-relating the different chapters and of publishing a magazine worthy of the Society.

These and other problems confronting the Society have been the object of study by the following gentlemen:

Messrs.	S. E. LeBrocq	Hamilton
	R. R. Thompson	Montreal
	G. H. Houston	Toronto
	Harold Wright	Hamilton
	K. A. Mapp	Toronto
	E. D. Macphee	"
	G. R. M. Dingle	"
	W. M. Lane	"
	S. H. Sorley	"
	J. W. Spence	"
	Geo. T. Bowden	Montreal

who have acted as an Advisory Committee to your Committee, and who, at a meeting held in Toronto on May 15th, 1936, made the following recommendations to us:

"That steps be taken to decentralize the management of the C. S. C. A. & I. E. in the following manner.

(a) That local chapters collect their own membership fees.

(b) That local chapters be assessed a certain amount per member to defray cost of Head Office services that may be determined by the Presidents' Committee. In stating cost per member it is understood that "member" will include non-residents, students or other class of membership attached to any particular chapter. (Amended by addition—Chapter territories to be defined).

(c) It is the opinion of this Committee that cost of "Cost and Management" should be reduced by at least two-thirds, and that magazine should be made more interpretive in character and be published at fewer intervals. (A statement by P. W. Wright of Montreal was referred to the committee, with the

suggestion that the magazine be continued monthly if practicable.)

(d) The functions of the General Secretary should be somewhat as follows:

1—To carry out duties required under the By-Laws.

2—Retain the membership register of the Society as a whole.

3—Act as editor of "Cost and Management."

4—Attend to correspondence between Head Office and Chapters.

5—Act as librarian and custodian.

6—Organization of inter-chapter activities.

(e) For the above services a remuneration of $1,200. per year is recommended. (Amended by addition—commencing May 1, 1937.)

In making these recommendations it is the intention of the Special Committee that the local chapters will assume their individual responsibilities for increasing membership and for improvement of programs, so that increased funds will be available. It should also be made clear that the additional funds obtained will not be used for purposes not approved by the officers of the Society.

It is likewise suggested that the Board accept these proposals on the basis of a two-year test of decentralized management."

With the above suggestions of the Advisory Committee, your Committee is in agreement.

1—The adoption of the recommendations of the Advisory Committee as hereinabove stated,

2—That the assessment on local chapters for Head Office be 50% of the fees collected,

3—That a special committee of five be appointed to arrange the details necessitated by the above recommendations, including the amendments to the By-Laws and the necessary regulations, the latter to be submitted for adoption at a special general meeting of the Society convened for that purpose, to be held before August 1st, 1936,

4—That these recommendations take effect as from May 1st, 1936, subject to the Society's commitments. (Amended effective May 1, 1936, in respect to division of fees.)

Respectfully submitted,
for the Committee
R. W. LOUTHOOD
President

Montreal, Que.
May 25th, 1936.

REPORT OF COMMITTEE OF PAST PRESIDENTS

COPY OF RESOLUTION OF MONTREAL CHAPTER SUBMITTED TO ANNUAL MEETING IN HAMILTON, MAY 27TH, 1935.

WHEREAS the activities and the growth of this Chapter of the Society are seriously restricted through lack of funds.

AND WHEREAS it is most important that the proportion of the membership of this Chapter, in relation to the total enrollment of the Society, be maintained at its present numerical strength,

AND WHEREAS the high cost of publishing the official organ "Cost and Management," and the expenses and salaries of the General Office, are greatly out of proportion to the money and the services made available to this Chapter,

THEREFORE BE IT RESOLVED: That the financial necessities of this Chapter be placed immediately before the Dominion Board with the request that a more equitable distribution of the funds be made between the Chapter and the General Office, having regard to the importance and the cost of Chapter activities, as compared with the amount paid for General Administration, and the maintenance of the name and prestige of the Chapters, which comprise the Society.

REFERENCE LITERATURE

RECEIVED IN MAY

Gold Mining Companies Prior to Production. Accounting System for. Canadian Chartered Accountant, May.

Agricultural Accounting, Aspects of. Canadian Chartered Accountant, May.

Accounting Concepts, Primary. Journal of Accountancy, May.

Municipal Accounting, Present Condition of. Journal of Accountancy, May.

Management Guidance, Major Accounting Reports for. National Association of Cost Accountants, May 1.

Confectionery Plant, Study of a Cost Plan for a Small. National Association of Cost Accountants, May 15.

Managerial Accounting Control. Certified Public Accountant, May.

Distribution, Cost of. The Cost Accountant, April.

GENERAL ACCOUNTANTS, MONTREAL BRANCH

At the annual meeting of the Montreal branch of the General Accountants' Association on May 28th, H. Whiston was elected chairman for the 1936-1937 season; J. E. Beauvais, vice-chairman; and

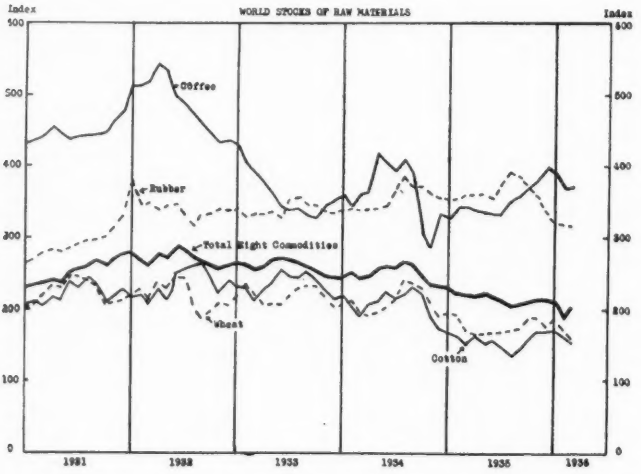
Hector Bertrand was re-elected secretary-treasurer. Directors were chosen as follows: F. D. Clark, F. A. Doughty, John Rhodes, D. Hart, A. J. Doucet, L. Galipeau, M. J. Morency. L. Ouelette and A. V. Madge; auditors, B. W. Huggins and Romeo Caron; honorary librarian, E. E. Read.

Gaston Choquette, retiring chairman, reported a successful year. Other reports covering the season's work were read by the following convenors of committees: employment, J. E. Beauvais; finance, F. D. Clark; lectures, A. V. Madge; publicity, John Rhodes; reception, L. Viau.

RAW MATERIALS GROWING SCARCER

By W. A. McKAGUE

The immense surpluses of rubber, coffee, wheat and other raw materials, which depressed prices on the commodity markets back in 1931 and 1932, have now disappeared in part. This was accomplished by drastic curtailment in production, which made 1932 and 1933 the worst years of the depression in respect to industrial activity; and since then there has been a gradual gain in demand, which in turn has brought some stimulus to production, while at the same time eating further into accumulated supplies.



From the long term viewpoint, stocks of several commodities are still fairly high, but in relation to current consumption the situation

is much stronger than it was in 1932 and 1933. The United States Department of Commerce assembles figures of world stocks of eight important commodities, expressing them in percentages of the average for the years 1923-25 inclusive. When these eight series of figures are combined, an index showing the trend of all of them is reached. This index touched a high point of 285 in May, 1932, meaning that average stocks then were 285 per cent of their level. By the early months of 1936, however, the figure was down to about 200, indicating a net absorption of about 30 per cent of the maximum.

It is important to bear in mind that the figures dealt with are not entirely "surplus", or amounts produced beyond consumers' needs. In every important commodity, a working or visible supply of some kind is necessary to permit trade to be carried on; many of them, like wheat, are produced in annual crops, and at least enough must be carried in store to last the year. If the visible supply threatened to disappear altogether, prices would rise to a panic level, and the situation would be far from normal.

To those in Canada who have heard much about the excess of wheat, it may be surprising to learn that the figures for wheat have remained below the average for the eight commodities. At their peak, world supplies of wheat were less than 2½ times their 1923-25 level, and latest figures show them only 161 per cent of that level.

Coffee has been one of the worst offenders, accumulating in 1932 to more than five times its average. Through some destruction of low grades, and general increase in consumption at low prices, this situation have been remedied in small degree, but stocks are still over 350 per cent. Rubber has been not far behind, reaching its peak less than a year ago, but since then there has been considerable shrinkage in rubber stocks. Rubber supplies have at times been kept under control by leading producers, but at other times this control has broken down and prices have fallen extremely low. Both rubber and coffee are important products of Brazil, and these conditions have had unfortunate effects on that country.

The trend in cotton has followed closely on that in wheat, stocks being high from 1931 to 1933, but being substantially reduced since then.

The four other commodities included (but not charted) are silk, sugar, tea and tin. Stocks of silk did not run extremely high, and according to latest figures are less than double their 1923-25 level. Sugar ran to over three times normal, and is still plentiful. The situation in tea has been kept well in hand by the planters, stocks being now just 30 per cent above average. Tin developed a surplus during the depression, but output was brought under definite control, to such an extent, in fact, that stocks for more than a year back have been less than in the 1923-25 period, and prices have been kept relatively high.

There always seems to be a paradox, in hard times arising from too much goods, but it is really just the primary producers and traders who suffer at that stage. As demand grows and surpluses disappear, they benefit by higher prices, and it undoubtedly is in that stage of the business cycle that we find ourselves at present.

CHAPTER NOTES

MONTREAL CHAPTER ANNUAL MEETING

Reporting increased membership and improved attendance, the annual meeting of Montreal Chapter was held recently in the Arts Building of McGill University, under the chairmanship of the retiring president, P. W. Wright. L. N. Buzzell. C.A., of McDonald, Currie & Co., was elected president for the coming year, with E. J. Loiselle, of Canadian International Paper Co., as vice-chairman.

In addition, the following were elected directors of the Montreal Board: G. I. MacKenzie, B.Sc.; H. W. Blunt, C.A.; J. G. Renaud; A. V. Madge; J. S. Miller; T. Ashworth; T. I. Smyth; R. E. Heartz, M.E.I.C.; J. E. Beauvais, C.G.A., A.C.I.S.; W. D. Sanford; R. Joubert, C.A.; B.A. Dugal and E. R. Maloney.

Proposed as local members of the Dominion Board were: G. T. Bowden, F.C.I., A.C.I.S.; J. P. Rolland; R. Schurman, C.A.; D. R. Patton, B.Com., C.A.; P. E. Dufresne and P. W. Wright. The following members are listed as Dominion Past Presidents and are automatically members of the Dominion Board: Lorenzo Belanger, C.G.A., C.P.A.; Wm. Carswell, C.A.; R. W. Louthood, A.C.I.S.; L. A. Peto. and Prof. R. R. Thompson, M.C., V.D., A.C.A., C.A.

TORONTO

Toronto Chapter concluded its 1935-36 season with a dinner and entertainment on May 7th which proved to be one of the best enjoyed events in its history. The dinner was at the rooms of the Canadian Military Institute, which were secured for us several times this season by Chairman Dingle. Reports of the year's activities showed that the Chapter had had a successful season. Some pocket note books, kindly donated by Copeland-Chatterson Co. Ltd., through Mr. D. W. Ewles, were distributed by draw, and the lucky recipients should thereby be able to keep track of their engagements or their budgets for another year.

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COMPTOMETER 50th ANNIVERSARY 1886-1936

COMPTOMETER

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Following the dinner and discussion, the members and their friends went to the Maple Leaf Gardens to witness wrestling bouts, in which Steel, O'Mahoney and lesser lights participated. All those present seemed to enjoy this novelty, and came away with the impression that wrestling was a harder way of earning a living than is accounting —at least it looked harder.

As a result of election of directors at the meeting, and of election of officers at a meeting of the directors a few days later, the following are in charge of the Chapter's affairs for the ensuing year:

Chairman, C. P. Roberts, F.C.A., J. P. Langley & Co., Toronto; vice-chairman, Geo. Appleton, Toronto Hydro-Electric System; treasurer, R. F. Bruce Taylor, C.A., Edwards, Morgan & Co.; secretary, J. M. McKee, International Business Machines Co., Ltd. Directors: R. S. M. Ausman, Gurney Foundry Co. Ltd.; W. T. Brickenden, Thorne, Mulholland, Howson & McPherson, Toronto; H. E. Bunt, Lever Bros., Ltd.; R. W. E. Dilworth, C.A., Clarkson, Gordon, Dilworth & Nash; H. M. Hetherington, Viceroy Mfg. Co. Ltd.; C. D. Landell, Canada Dry Ginger Ale, Ltd.; R. H. Metcalfe. Massey-Harris Co. Ltd.; C. G. McConnell, C.A., Riddell, Stead, Graham & Hutchison; H. S. Pratt, Consolidated Bakeries, Ltd.; W. F. Putt, Steel Co. of Canada, Ltd.; and R. J. Williams, Canadian Wm. A. Rogers, Ltd.

The following were proposed as nominees for the Dominion Board:

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PERSONNEL DEPARTMENT FUNCTIONS

Mr. Harry Taylor, whose valuable address on "Job Analysis" was printed in May Cost and Management, and who is in charge of personnel work with the Canadian National Carbon Co., Ltd., Toronto, recently prepared, in connection with a discussion in another organization, the following list of functions of a personnel department. He points out that these are merely suggestions from his own viewpoint, and that others may differ on many of the details.

Employment Functions:

1. Hiring
   - (a) Job Specifications
   - (b) Recruiting
   - (c) Interviewing
   - (d) Follow-up of Application
   - (e) Vocation Tests
   - (f) Replacement and Introduction
2. Transfers and Promotions
3. Follow-up of New and Transferred Employees
4. Terminations
   (Interview of those leaving voluntarily to determine reason)
5. Records and Reports
   - (a) Employees' Records
   - (b) Labor Reports
   - (c) Progress Reports
   - (d) Absentee Reports
   - (e) Tardiness
   - (f) Stability
   - (g) Termination Analysis
   - (h) Employment Costs
   - (i) Labor Turnover
6. Absentee Follow-up
7. Adjustment of Grievances
8. Hours of Labor
9. Contact on Outside Conditions
   - (a) Labor Supply
   - (b) Labor Surveys
   - (c) Immigration and Emigration
   - (d) Pending Labor Legislation

Training and Educational Functions:

1. Training New Employees in Company Policies
2. Co-operation with Department Heads in Job Training
3. Preparation and Distribution of Employee's Hand Book
4. Plant Meetings
5. Foreman Training
6. Discussion Groups
7. Information and Guidance on Courses offered by Public Schools, Colleges, etc.
8. Bulletin Boards
9. Plant Paper
10. Circulating Library
11. Citizenship Classes

Medical Functions:

1. Plant Hospital
2. Medical Service
3. Physical Examinations
   (a) New Employees
   (b) Re-examination of Old Employees
4. Medical Records
5. Health, Education and Sickness Prevention
6. Plant Sanitation
   (a) Light, Heat, Cold
   (b) Ventilation
   (c) Dust and Fumes
7. Control of Occupational Diseases

Safety and Fire Prevention Functions:

1. Safety Organization.
2. Safety Meetings
3. Plant Housekeeping
4. Plant Drills
5. Accident Investigation and Reports
6. Safety Inspections

Service and Welfare Functions:

1. Plant Restaurant
2. Recreational and Social Activities
3. Group Life Insurance
4. Sick Benefits or Disability Allowances
5. Termination Allowances
6. Workmen's Compensation
7. Savings Plan
8. Vacations
9. Financial Aid and Advances
10. Retirement Plan
11. Fuel Purchase Plan
12. Seating Equipment

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17. Parking Accommodation
18. Garage Services
19. Co-operative Buying
20. Suggestion System
21. Mother's Allowance (Provincial)
22. Old Age Pensions (Provincial)
23. Unemployment Insurance
24. Transportation.
25. House Accommodation
26. Disposition of Scrap Wood, etc., to Employees
27. Rest Rooms
28. Lockers and Washrooms
29. Janitor Service
30. Watchman Service

Wage Payment Functions:

1. Hiring Rates
2. Increases
3. Job Analysis
4. Job Rates
5. Job Standardization
6. Application of Incentives
7. Reports of Earnings
8. Overtime Allowances

The golfer stepped up to the tee and drove off. The ball sailed straight down the fairway, leaped onto the green and rolled into the hole. The golfer threw his club in the air with excitement.

"What have you suddenly gone crazy about?" asked his wife, who was trying to learn something about the game.

"Why, I just did a hole in one," yelled the golfer, a wild gleam of delight in his eyes.

"Did you?" asked his wife, placidly. "Do it again, dear, I didn't see you."

* * * *

"It is no good," says a beauty hint, "thinking of your new spring hat until you have decided on your new spring face."

* * * *

A judge says that his only acquaintance with motor cars is through dodging them. One doesn't learn a great deal about them by this method, but it is certainly a step in the right direction.